

OBJECTS LOCATION

Engineering geophysical surveys are used, among other applications, for **detection the underground** facilities which can be for example the foundations, walls, slabs reinforced, unknown rooms and infrastructure, etc.

These studies, carried out by different methods and techniques allow to **pinpoint the exact location** of objects below the surface, and allow to identify their geometrical parameters.

Such objects, not removed before the start of engineering earthworks, may **disrupt or even suspend** construction works on new projects or extensions to existing structures.

The detection of unknown objects is also very important for proper foundation of bearing elements of buildings or other facilities.



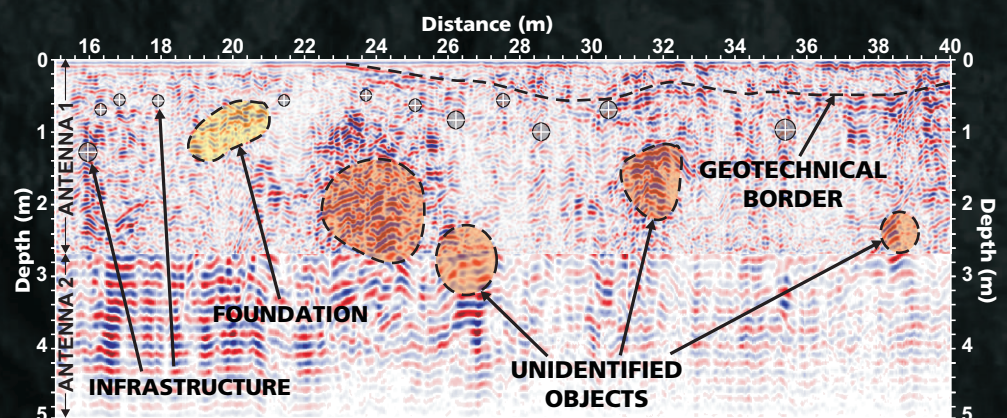
Seismic acquisition for searching underground rooms (chambers, tunnels) or their remains around the archaeological site.

Most often, the following geophysical methods and techniques are used:

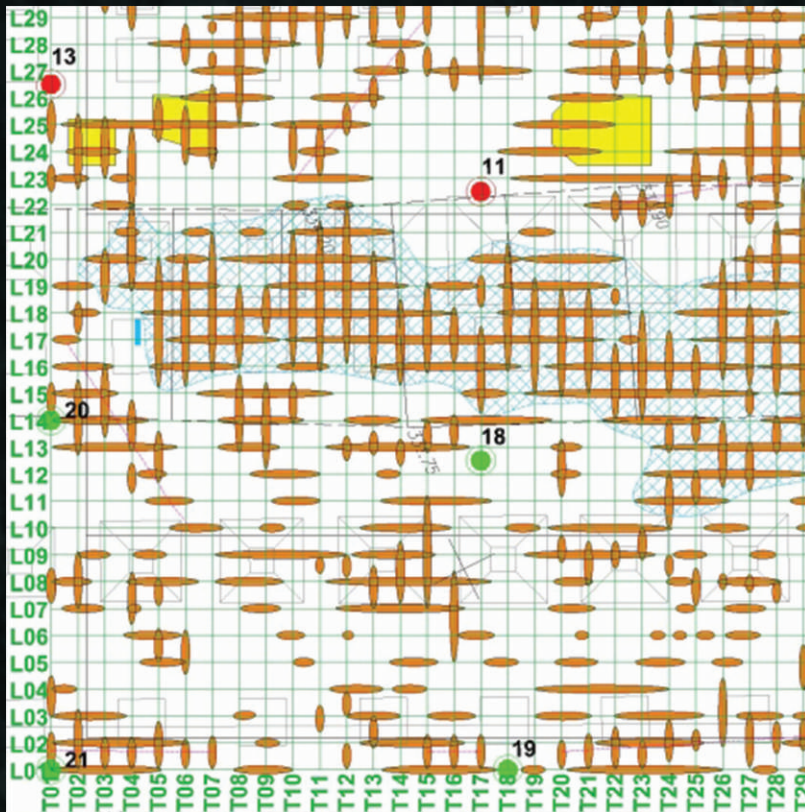
-  GPR profiling
-  GPR mapping
-  microseismic MASW 2D profiling
-  electrical resistivity tomography ERT 2D

These methods are best for the location of underground facilities, but for most subsurfaces (up to a few meters) and for small objects most accurate is the GPR survey. For depth below a few meters, better results provides microseismic method.

Georadar cross section for searching for unidentified objects as chambers, cellars and corridors, located on the area adjacent the historic buildings.

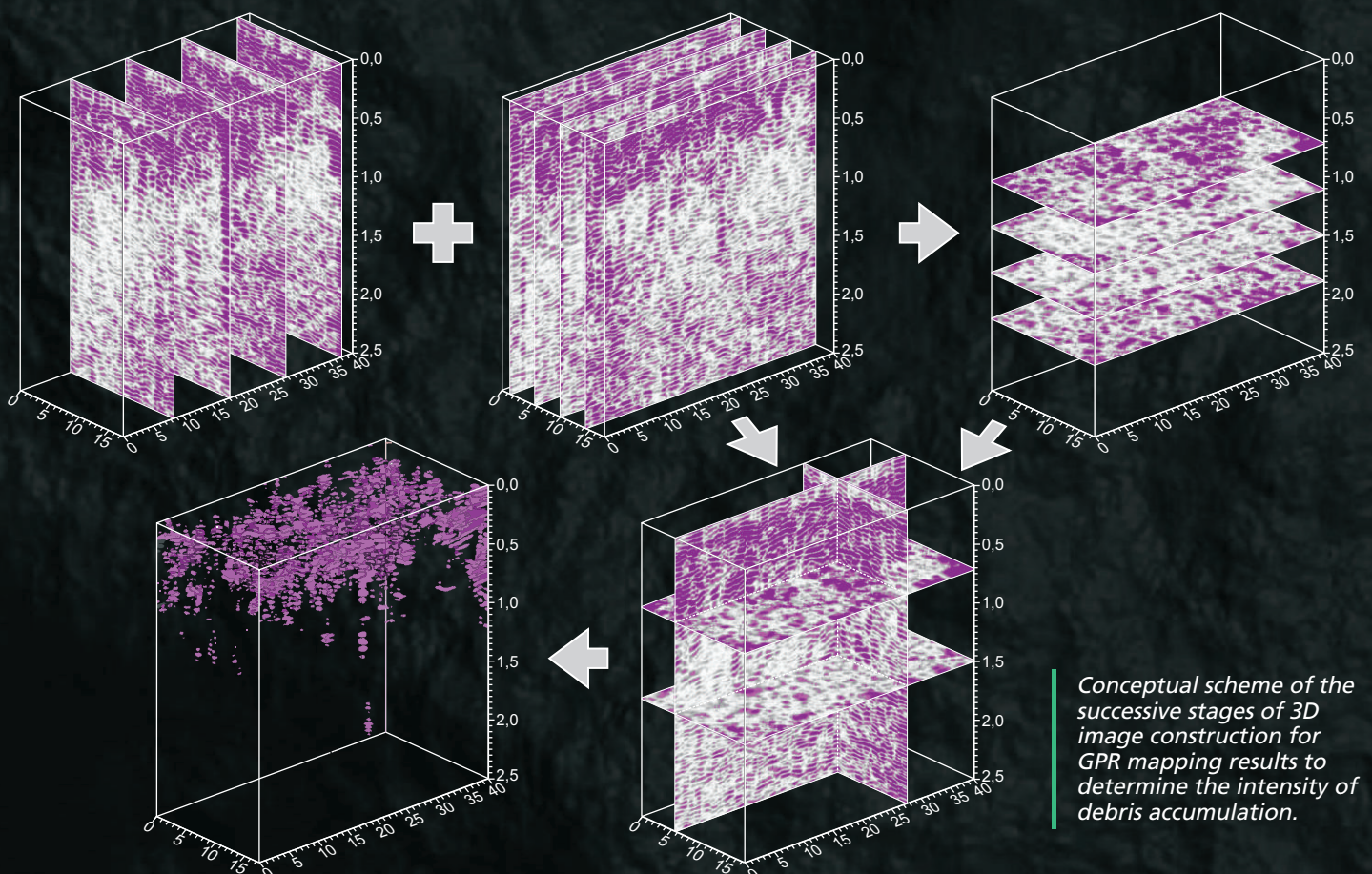


GPR MAPPING



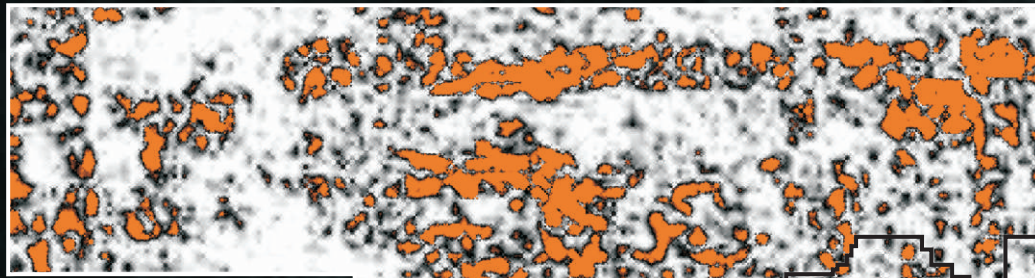
Sample map for design purposes with marked GPR anomalies obtained the profiling technique and spatial interpretation for the purpose of searching for remains of objects in the ground. The search was performed in a grid of profiles (green). Pointed the presence of several reinforced concrete plates (yellow) and areas with high concentrations of debris and remains of foundations (blue) at the site of the planned investment.

The main difference between the GPR profiling and mapping is the process of data processing and presentation. In GPR mapping, the result is interpreted maps or 3D models of amplitudes and the interpretation is based on the analysis of their clusters. This gives the possibility to analyze often complex shapes and waveforms. Unfortunately, in the case of embankments, the objects that are sought are often invisible among numerous disturbances.

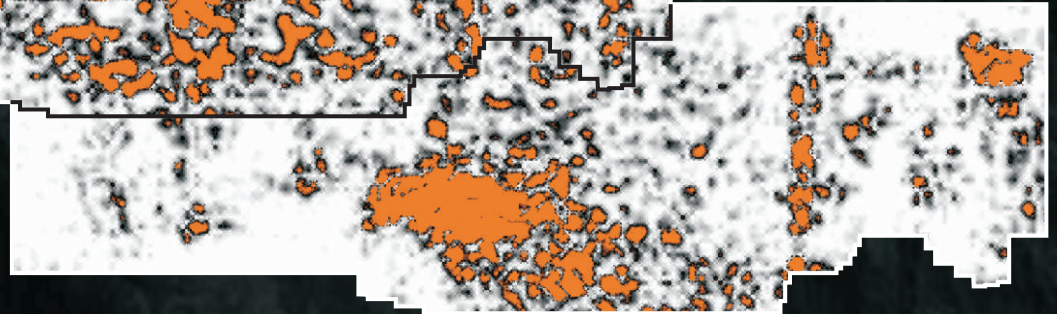


Conceptual scheme of the successive stages of 3D image construction for GPR mapping results to determine the intensity of debris accumulation.

H = 0,5 m b.g.l.



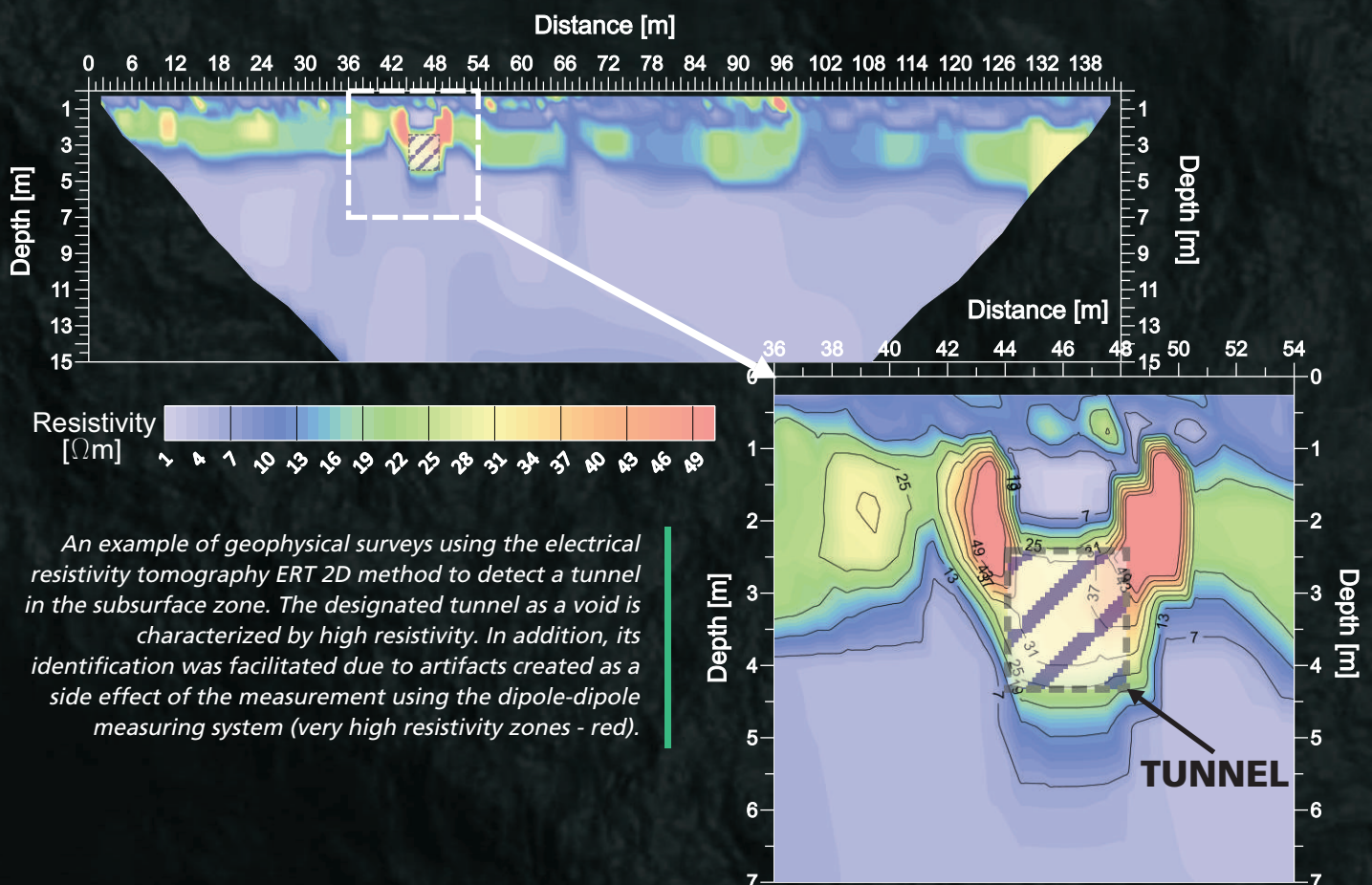
H = 1,5 m b.g.l.



Sample depth maps of 0.5 m and 1.5 m below the ground level based on measurements made by the GPR mapping method in a regular measurement grid in order to locate the linear infrastructure.

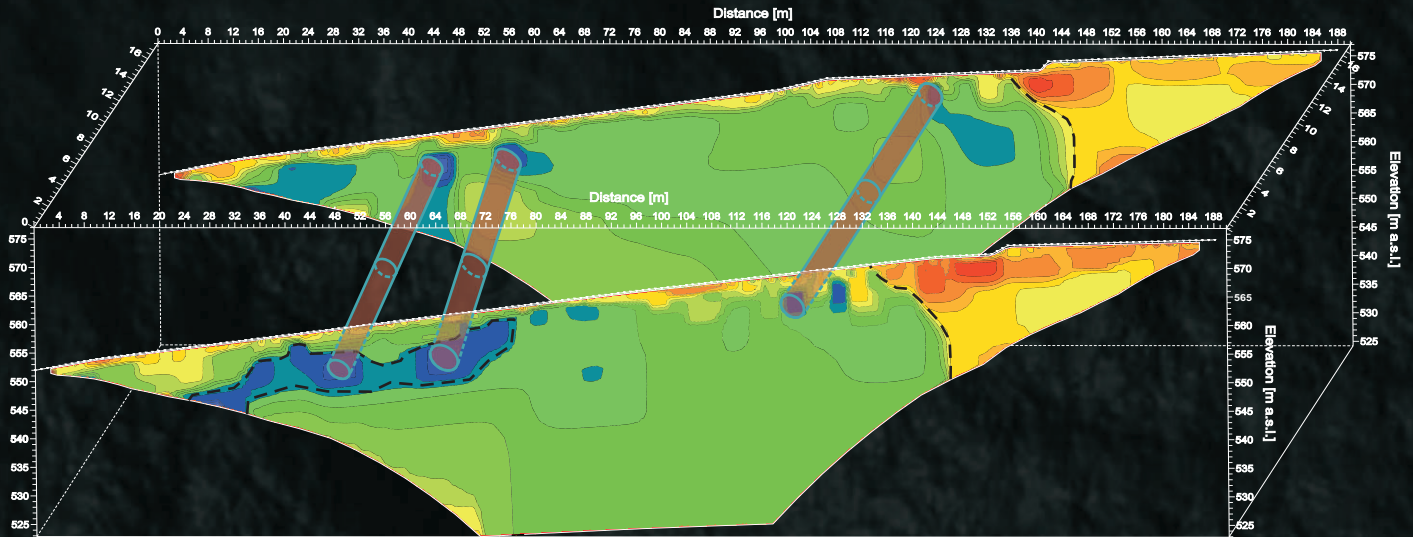
DC ELECTRICAL RESISTIVITY SURVEYS

Geophysical surveys using the electrical method is based on the flow of electric current through the geological center. This method allows the separation of zones with different electrical properties. Such surveys allows for the location of all kinds of voids, such as tunnels, chambers, cellars, crypts or other anthropogenic objects, i.e. foundations, walls, graves, etc.



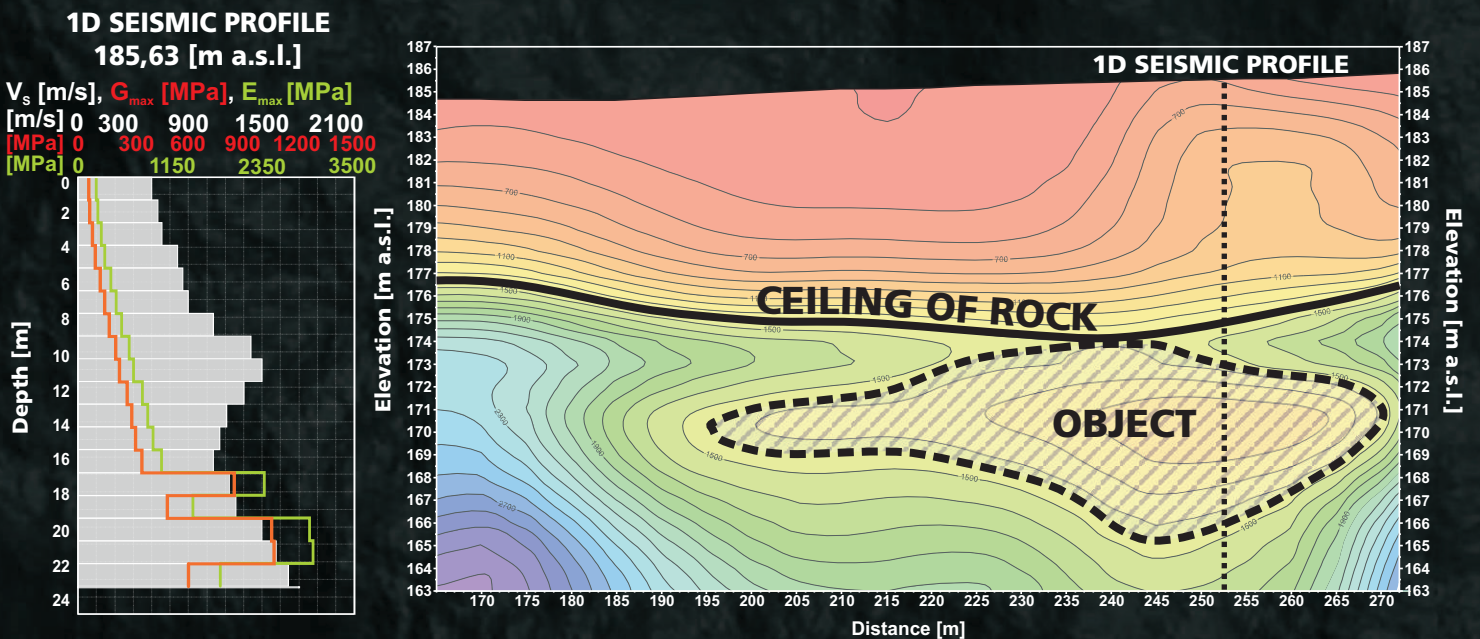
An example of geophysical surveys using the electrical resistivity tomography ERT 2D method to detect a tunnel in the subsurface zone. The designated tunnel as a void is characterized by high resistivity. In addition, its identification was facilitated due to artifacts created as a side effect of the measurement using the dipole-dipole measuring system (very high resistivity zones - red).

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An example of geophysical survey to search for tunnels hollowed in the rock with the use of parallel electrical resistivity tomography ERT profiles.

Non-invasive geophysical studies save time and provide high precision in detecting objects. Another applications of such studies is archeology for location of cellars, chambers, walls, tombs, tunnels and crypts. There are several different geophysical methods but their selection should be precisely adapted to the physical properties of the objects (eg. dimensions, the material from which they are made). Presumed depth of their presence in the examined medium is also important. This allows **optimization the methodology** and scope of specific studies.



Example of interpreted seismic cross section MASW 2D (right) and seismic profile MASW 1D (left), indicating the location of zones of reduced compaction, which can be possible location of the old tunnel.